BCE-501	Geotechnical Engineering	2L:0T:0P	2 credits

Pre-requisites: The study of the geological material properties on a construction site are important to allow design and construction of stable structures that: do not settle, deform or crack and. do not fall down due to foundation failure.

Course Objectives:

CO1	To provide a coherent development to the students for the courses in sector of Geotechnical Engineering & Soil Improvement Techniques etc
CO2	To present the foundations of many basic Engineering tools and concepts related Geotechnical Engineering.
CO3	To give an experience in the implementation of Engineering concepts which are applied in field of Geotechnical Engineering
CO4	To involve the application of scientific and technical principles of planning, analysis, design of foundation along with soil improvement techniques.

Module 1:

Introduction—Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio- moisture content, unit weight- percent air voids, saturation- moisture content, moisture content- specific gravity etc.

Plasticity Characteristics of Soil - Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Classification of Soils-Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups.

Module 2:

Permeability of Soil - Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping- out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets.

Effective Stress Principle- Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition. Stresses in soils — Introduction,

stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart. Contact pressure under rigid and flexible area, computation of displacements from elastic theory

Module 3:

Consolidation of Soil - Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

Compaction of Soil- Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control

Shear Strength - Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behaviour of UU, CU and CD tests, pore-pressure measurement, computation of effective shear strength parameters. unconfined compression test, vane shear test

Module 4:

Stability of Slopes- Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.

Soil Exploration- Introduction, methods of site exploration and soil investigation, methods of boring, soil samplers, sampling procedures, trail pits, borings, penetrometer tests, analysis of borehole logs, geophysical and advance soil exploration methods.

report based on borehole log data and various in-situ tests

Course Outcomes: After the completion of the course the student will be able to:

CO1	Students are able to classify soils
CO2	Students are able to know how water affect the soil parameters
CO3	Students are able to understand the compaction, consolidation and shear strength parameters of soil
CO4	Students are able to calculate the compaction, consolidation and shear strength of soil
CO5	Student will solve actual problems of stability with various material
CO6	Studnets are able to apply various theories and predict the risk factor.

Head
Department of Civil Engineering
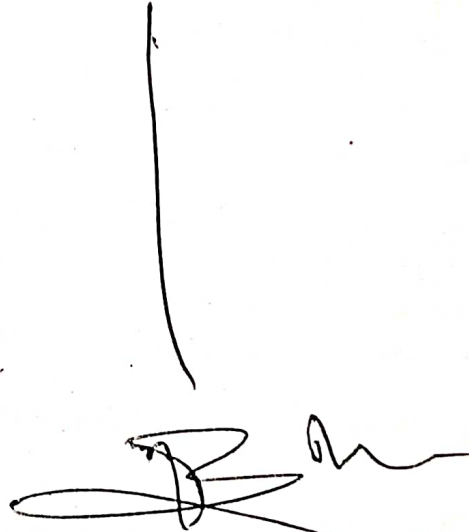Invertis University
Bareilly-243123, UP

Registrar
Invertis University
Bareilly

Dean
Faculty of Engineering & Technology
Invertis University
Bareilly-243123, UP

Text/Reference Books:

1. Soil Mechanics by Craig R.F., Chapman &Hall
2. Fundamentals of Soil Engineering by Taylor, John Wiley &Sons

3. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., PrenticeHall,NJ
4. Principles of Geotechnical Engineering, by Braja M. Das, CengageLearning
5. Principles of Foundation Engineering, by Braja M. Das, CengageLearning
6. Essentials of Soil Mechanics and Foundations: Basic Geotechnics by David F.McCarthy
7. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, andGholamrezaMesri.
8. Geotechnical Engineering: Principles and Practices of Soil Mechanics and FoundationEngineering (Civil and Environmental Engineering) by V.N.S.Murthy.

Head
Department of Civil Engineering
Invertis University
Bareilly-243123, UP

Dean
Faculty of Engineering & Technology
Invertis University
.Bareilly-243123, UP

Registrar
Invertis University
Bareilly